

## Reading Preview

## Key Concepts

- What characteristics do angiosperms share?
- What is the function of an angiosperm's flowers?
- How do angiosperms reproduce?
- How do monocots differ from dicots?

## Key Terms

- angiosperm • flower • sepal
- petal • stamen • pistil
- ovary • fruit • monocot
- dicot

## Target Reading Skill

**Building Vocabulary** Using a word in a sentence helps you think about how best to explain the word. After you read the section, reread the paragraphs that contain definitions of Key Terms. Use all the information you have learned to write a meaningful sentence using each Key Term.



◀ Rafflesia

## Lab zone Discover Activity

## What Is a Fruit?

1. Your teacher will give you three different fruits that have been cut in half.
2. Use a hand lens to carefully observe the outside of each fruit. For each fruit, record its color, shape, size, and other external features. Record your observations in your notebook.
3. Carefully observe the structures inside the fruit. Record your observations.

## Think It Over

**Forming Operational Definitions** Based on your observations, how would you define the term *fruit*?



You probably associate the word *flower* with a sweet-smelling plant growing in a garden. You certainly wouldn't think of something that smells like rotting meat. But that's exactly what the corpse flower, or rafflesia, smells like. These flowers, which grow on vines in Asia, are huge—nearly 1 meter across! You won't be seeing rafflesia in your local florist shop any time soon.

Rafflesia belongs to the group of seed plants known as **angiosperms** (AN jee uh spurmz). **All angiosperms, or flowering plants, share two important characteristics. First, they produce flowers. Second, in contrast to gymnosperms, which produce uncovered seeds, angiosperms produce seeds that are enclosed in fruits.**

Angiosperms live almost everywhere on Earth. They grow in frozen areas in the Arctic, tropical jungles, and barren deserts. A few angiosperms, such as mangrove trees, can live at the ocean's edge.

## Objectives

After this lesson, students will be able to  
**A.5.3.1** Describe the characteristics shared by angiosperms.

**A.5.3.2** State the function of an angiosperm's flowers.

**A.5.3.3** Explain how angiosperms reproduce

**A.5.3.4** Tell how monocots differ from dicots.

## Target Reading Skill

**Building Vocabulary** Explain that using a vocabulary strategy such as using the words in a sentence helps students define key-concept words.

## Answers

Have students write what they know about each key term before reading the definitions in the section. Explain that connecting what they already know about key terms helps them to remember the terms. As they read each passage that contains key terms, remind them to write the definitions in their own words.

## All in One Teaching Resources

- [Guided Reading Study Worksheet: Angiosperms, Use Target Reading Skills](#)

## Preteach

## Build Background Knowledge

L2

## Flower Descriptions

Ask students to describe how the flowering plants or trees they are familiar with change throughout the year. Encourage students to use specific examples, such as a tree in the schoolyard or a flowering house plant. Post several pictures of a single flowering plant taken at different times of the year. Have students describe the changes that take place in chronological order. Prompt students to include times of increased insect or animal activity in their descriptions, if applicable.

## Discover Activity

**Skills Focus** Forming operational definitions

L1

*beginning this activity.* Students may not think that some vegetables, such as tomatoes and peppers, are considered by botanists to be fruits. Challenge students to determine why.

**Materials** hand lens; metric ruler; three different fruits, such as apples, cherries, peaches, plums, tomatoes, or peppers

**Time** 15 minutes

**Tips CAUTION:** Tell students not to taste or eat the fruit. Check for food allergies before

**Think It Over** Possible definition: Fruits contain seeds and have a fleshy edible part. They vary in color, shape, and the number of seeds they contain.

## Instruct



For: The Structure of a Flower activity  
Visit: PHSchool.com  
Web Code: cep-1053

Students can interact with the art of the structure of a flower online.

## The Structure of Flowers

### Teach Key Concepts

L2

#### Flowers Are Reproductive Organs

**Focus** Remind students that in gymnosperms, the cone is the reproductive structure.

**Teach** Explain that in angiosperms, a flower is the reproductive structure. Ask: **What is the function of flowers?** (*To reproduce*) **What kinds of structures do you expect to find in a flower?** (*Male and female reproductive structures of the plant*) Refer students to Figure 13. Ask them to examine each part as student volunteers read the captions and the sentences in the passage containing key terms. Ask: **What structures make up the male parts of a flower?** (*Stamens with their filaments and anthers*) **The female parts?** (*Pistils, which have stigmas, styles, and an ovary*) **What purpose do the color and shape of the petals serve?** (*To help ensure pollination*)

**Apply** Ask: **How is it an advantage for a plant to have many flowers together in a single structure?** (*More flowers might attract more pollinators, which increases the chance of pollination.*) **learning modality: visual**

**Extend** The Active Art will show students how the structures of flowers are specialized for reproduction.

### All in One Teaching Resources

- [Transparency A45](#)

### Independent Practice

L2

### All in One Teaching Resources

- [Guided Reading and Study Worksheet: Angiosperms](#)

Student Edition on Audio CD

FIGURE 13

### The Structure of a Flower

Like most flowers, this lily contains both male and female reproductive structures.

#### Stamens

Stamens are the male reproductive parts of a flower. Pollen is produced in the anther, at the top of the stalklike filament.

Stamen  
Anther  
Filament

#### Pistils

Pistils are the female reproductive parts of a flower. A pistil consists of a sticky stigma, a slender tube called the style, and a hollow structure, called the ovary, at the base.

Pistil  
Stigma  
Style  
Ovary

#### Sepals

Sepals are the small, leaflike parts of a flower. The sepals protect the developing flower.

Sepal

#### Petals

Petals are usually the most colorful parts of a flower. Pollinators are attracted by the petals' colors and scent.

Petal



For: The Structure of a Flower activity  
Visit: PHSchool.com  
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## The Structure of Flowers

Flowers come in all sorts of shapes, sizes, and colors. But, despite their differences, all flowers have the same function—**reproduction**. A **flower** is the reproductive structure of an angiosperm. Figure 13 shows the parts of a typical flower. As you read about the parts, keep in mind that some flowers lack one or more of the parts. For example, some flowers have only male reproductive parts, and some flowers lack petals.

**Sepals and Petals** When a flower is still a bud, it is enclosed by leaflike structures called **sepals** (SEE pulz). Sepals protect the developing flower and are often green in color. When the sepals fold back, they reveal the flower's colorful, leaflike **petals**. The petals are generally the most colorful parts of a flower. The shapes, sizes, and number of petals vary greatly from flower to flower.

**Stamens** Within the petals are the flower's male and female reproductive parts. The **stamens** (STAY munz) are the male reproductive parts. Locate the stamens inside the flower in Figure 13. The thin stalk of the stamen is called the filament. Pollen is produced in the anther, at the top of the filament.

**Pistils** The female parts, or **pistils** (PIS tulz), are found in the center of most flowers. Some flowers have two or more pistils; others have only one. The sticky tip of the pistil is called the stigma. A slender tube, called a style, connects the stigma to a hollow structure at the base of the flower. This hollow structure is the **ovary**, which protects the seeds as they develop. An ovary contains one or more ovules.

**Pollinators** The colors and shapes of most petals and the scents produced by most flowers attract insects and other animals. These organisms ensure that pollination occurs. Pollinators include birds, bats, and insects such as bees and flies. The rafflesia flower you read about at the beginning of the section is pollinated by flies. The flies are attracted by the strong smell of rotting meat.



What are the male and female reproductive parts of a flower?



▲ A hummingbird pollinates a bright red flower.



▶ A honeybee is covered in the pollen of an orange flower.



▶ A bat pollinates an organ pipe cactus flower at night.

FIGURE 14

### Pollinators

Pollinators, such as insects, birds, and bats, are attracted to a flower's color, shape, or scent.

**Inferring** How might the white color of the cactus flower aid in attracting bats?



## Modeling Flowers

**Materials** construction paper, markers, toothpicks, modeling clay, cornmeal, drinking straws, dry peas, glue, tape, other arts and crafts materials, botany references or Internet resources

**Time** 20 minutes

**Focus** Remind students that flowers vary widely in structure. Explain that while most flowers contain both male and female reproductive parts, some flowers contain only one or the other.

**Teach** Divide students into four groups. Assign each group one of the following flowers: corn, tulip, wild rose, and sunflowers. Have students use references to locate diagrams of the reproductive structures of their flower. If they cannot locate structures on their flower, they may choose another type. Try to make sure that flowers with different arrangements of reproductive structures are represented. Encourage students to create a model of a flower showing its reproductive structures. Then have them sketch their model and label the parts. Confirm that the models are correctly constructed and the sketches correctly labeled. Ask groups to present their models to the class, then leave the models on display for all students to use as study aids.

**Apply** After students have presented their models, ask the class to compare and contrast the differences in the structures.

**learning modality: kinesthetic**

## Differentiated Instruction

### Less Proficient Readers

L1

**Organizing Information** Suggest that students construct concept maps to organize the information about angiosperms. With student input, write the key terms and main concepts of the section on the board. Then help students start the map. **learning modality: visual**

### Gifted and Talented

L3

**Researching Flowers in Art** Encourage students who are artistically talented to compare paintings of flowers by artists such as O'Keeffe, Van Gogh, Monet, and Picasso. Ask students to analyze the differences. (Possible answer: O'Keeffe included accurate details. Van Gogh used interpretative colors and limited detail.) **learning modality: visual**

## Monitor Progress

L2

**Skills Check** Have students make a compare/contrast table listing the male and the female parts of a flower.

### Answers

**Figure 14** White is easier to see at night.



Male: stamen—anther and filament; female: pistil—stigma, style, ovary



# Reproduction in Angiosperms

## Teach Key Concepts

L2

### Processes in Angiosperm Reproduction

**Focus** Ask: What reproductive structures are unique to angiosperms? (*Flowers and fruits*)

**Teach** Ask: After a plant has produced a mature flower, what is the first step in reproduction? (*Pollen falls on the stigma.*) What is this process called? (*Pollination*) What happens next? (*A sperm cell in the pollen joins with an egg cell inside the ovary.*) What is the process called? What is the result of the process? (*Fertilization, a zygote*) What happens to the ovary as the seed develops? (*The ovary changes into a fruit.*)

**Apply** Have students suppose they have discovered a new plant that has tiny green flowers against a background of green leaves. Ask: How do you think this plant is pollinated? (*Probably the wind because it does not have colorful flowers to attract animal pollinators*) **learning modality: visual**

### All in One Teaching Resources

- [Transparency A46](#)

### Lab zone Build Inquiry

L2

## Comparing and Contrasting Fruit

**Materials** whole fruit and fruit slices, such as grapes, coconut, apples, bananas, tomatoes, and so on

**Time** 10 minutes

**Focus** Review the definition of a fruit.

**Teach** **CAUTION:** Check for allergies before allowing students to handle fruit. Make certain students do not eat or taste the fruit. Encourage students to feel the shape, weight, and texture of several fruits. Ask students to describe how the physical characteristics of each fruit and its seeds might be related to the way in which its seeds are dispersed.

**Apply** Ask: What is the purpose of fruits being sweet and fleshy? (*Animals are more likely to eat the fruit, which helps the plants disperse its seeds.*) **learning modality: kinesthetic**

## Reproduction in Angiosperms

You can follow the process of angiosperm reproduction in Figure 16. First, pollen falls on a flower's stigma. In time, the sperm cell and egg cell join together in the flower's ovule. The zygote develops into the embryo part of the seed.

**Pollination** A flower is pollinated when a grain of pollen falls on the stigma. Like gymnosperms, some angiosperms are pollinated by the wind. But most angiosperms rely on birds, bats, or insects for pollination. Nectar, a sugar-rich food, is located deep inside a flower. When an animal enters a flower to obtain the nectar, it brushes against the anthers and becomes coated with pollen. Some of the pollen can drop onto the flower's stigma as the animal leaves the flower. The pollen can also be brushed onto the sticky stigma of the next flower the animal visits.

**Fertilization** If the pollen falls on the stigma of a similar plant, fertilization can occur. A sperm cell joins with an egg cell inside an ovule within the ovary at the base of the flower. The zygote then begins to develop into the seed's embryo. Other parts of the ovule develop into the rest of the seed.

**Fruit Development and Seed Dispersal** As the seed develops after fertilization, the ovary changes into a **fruit**—a ripened ovary and other structures that enclose one or more seeds. Apples and cherries are fruits. So are many foods you usually call vegetables, such as tomatoes and squash. Fruits are the means by which angiosperm seeds are dispersed. Animals that eat fruits help to disperse their seeds.

FIGURE 15

### Fruits

The seeds of angiosperms are enclosed in fruits, which protect and help disperse the seeds.



What flower part develops into a fruit?

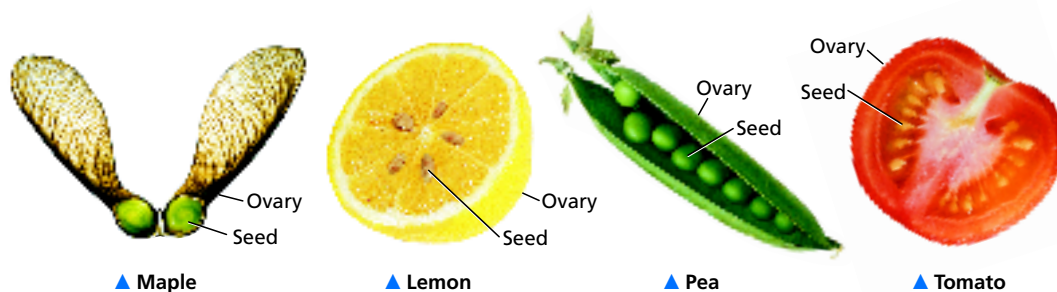
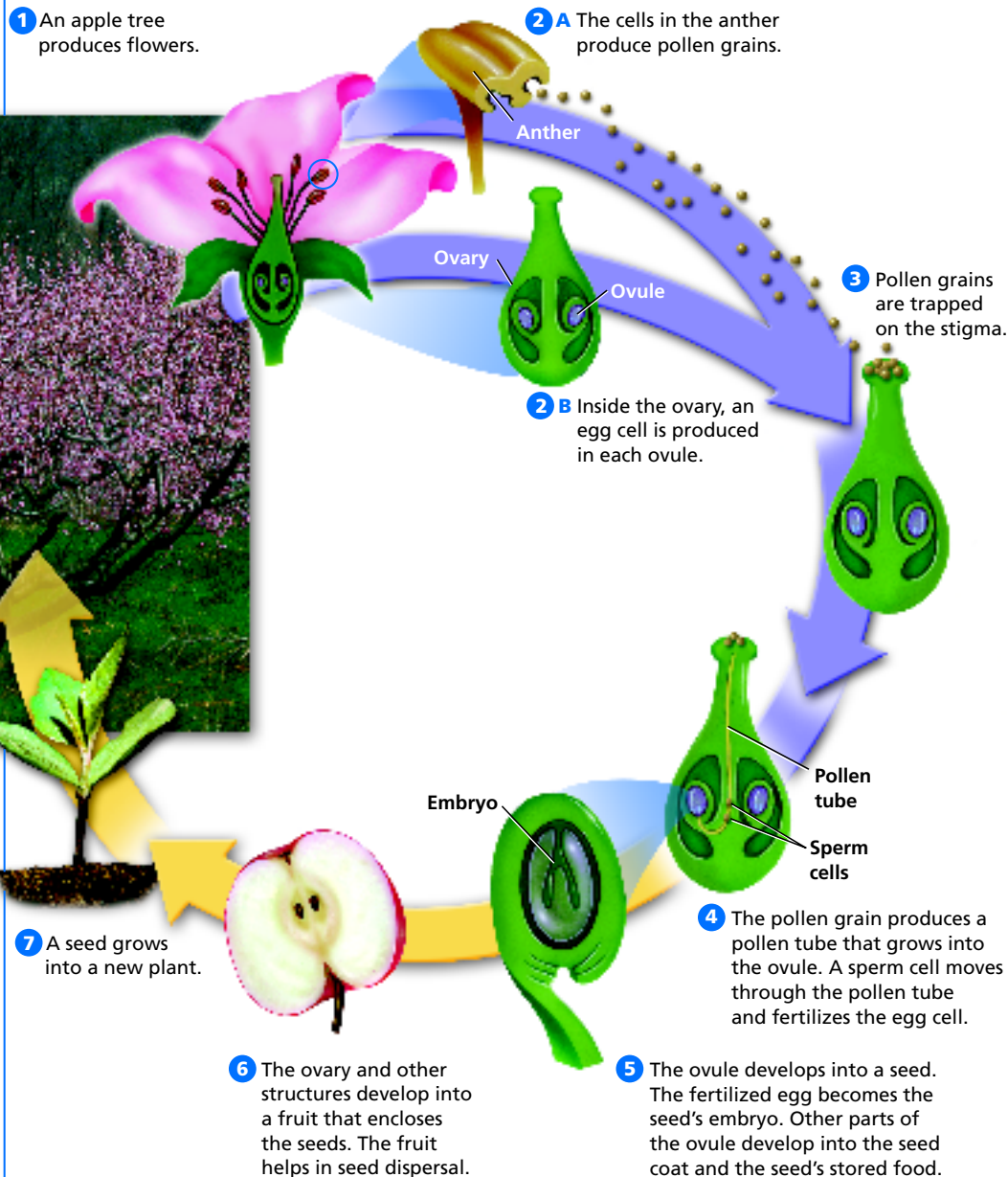


FIGURE 16

## The Life Cycle of an Angiosperm

All angiosperms have a similar life cycle. Follow the steps of pollination, fertilization, seed development, and dispersal in this apple tree.

**Interpreting Diagrams** What plant part does the ovule develop into?



## Use Visuals: Figure 16

### The Life Cycle of an Angiosperm

**Focus** Encourage students to follow the reproductive process of flowering plants shown in Figure 16.

**Teach** Make sure students can identify the ovary and anther in Step 1. Ask: **Why are there Steps 2A and 2B?** (One step is the male—cells in the anther produce pollen; the other step is the female—cells in each ovule produce egg cells.) As students review the steps in the visual, have them record what each of these structures produces and its role in the life cycle: anther (Pollen grains), ovule (Egg cell, seed), pollen grain (Pollen tube), ovule's wall (Seed coat), and ovary (Fruit). Ask: **What is the purpose of the stigma?** (To trap pollen) **What happens to the ovule parts that are not the embryo?** (They develop into a seed coat and stored food.) **What is the purpose of fruit?** (Enclose seeds and aid in seed dispersal.)

**Apply** Call students' attention to Step 6. Ask students to infer how animals that eat fruit help to ensure the germination of seeds. (When animals eat fruits, the seeds pass through the animals' digestive system. When the animals travel, they disperse seeds away from the parent plant. Seeds may then have a better chance of germinating because they won't have to compete with the parent plant for resources.) **learning modality: visual**

## Differentiated Instruction

### English Learners/Beginning

**Comprehension: Link to Visual** Help students construct a table listing each reproductive structure, what it produces, and what role the structure plays in the plant's life cycle. Use the headings *Plant Part*, *Produces*, and *Role*. Entries in the *Plant Part* column should include *anther*, *ovule*, *ovary*, *sperm cells*, and so on.

**learning modality: visual**

L1

### English Learners/Intermediate

**Comprehension: Modified Cloze** Have student pairs write sentences with blanks for key terms and concepts, then switch with another pair to fill in the blanks.

Example: The anther produces pollen grains that fertilize the egg.

**learning modality: verbal**

L2

## Monitor Progress L2

**Oral Presentation** Have students describe the roles of an orange blossom and an orange in the reproduction of an orange tree.

### Answers

**Figure 15** A seed



The ovary and other structures

# Types of Angiosperms

## Teach Key Concepts

### Monocots and Dicots

**Focus** Remind students that a cotyledon is a seed leaf that sometimes stores food for the plant embryo.

**Teach** Ask: How can you classify angiosperms by the number of cotyledons? (A monocot has one seed leaf; a dicot has two seed leaves.) How are the petals of each type different? (A monocot has petals in groups of three or multiples of three; a dicot has petals in groups of four or five or multiples of four or five.)

**Apply** Ask: What can you infer about a cross-section of a fossilized stem that has holes scattered randomly throughout? (It was vascular because it had a stem with vascular tissue. It probably was seed bearing and a monocot because the vascular tissue was scattered throughout the stem.) **learning modality: verbal**

### All in One Teaching Resources

- [Transparency A47](#)

## Math Skills

**Math Skills** Whole number operations

**Focus** Reinforce that monocots may have more than 3 petals.

**Teach** Ask: How can you use the number of petals to determine if a flower is a monocot or a dicot? (Divide the number of petals by 3. It is a monocot if you get a whole number.)

**Answer** 12 and 16

# Angiosperms in Everyday Life

## Teach Key Concepts

### Uses of Angiosperms

**Focus** Tell students that angiosperms have greater commercial use than gymnosperms, except in forest products.

**Teach** Ask: Besides for food, how do people use angiosperms? (Clothing, rubber, furniture, medications)




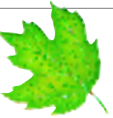
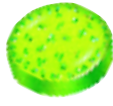
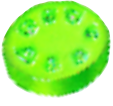


**Apply** Ask students to name specific food crops that are angiosperms. (Rice, wheat, corn, all types of fruits and vegetables)

**learning modality: verbal**

FIGURE 17

**Monocots and Dicots** Monocots and dicots differ in the number of cotyledons, the pattern of veins and vascular tissue, and the number of petals.

**Interpreting Tables** How do monocot and dicot leaves differ?

Comparing Monocots and Dicots			
Plant Part	Monocots		Dicots
Seed	 One cotyledon	 Two cotyledons	
Leaf	 Parallel veins	 Branching veins	
Stem	 Bundles of vascular tissue scattered throughout stem	 Bundles of vascular tissue arranged in a ring	
Flower	 Flower parts in threes	 Flower parts in fours or fives	

# Types of Angiosperms

Angiosperms are divided into two major groups: monocots and dicots. “Cot” is short for *cotyledon*. Recall from Section 1 that the cotyledon, or seed leaf, provides food for the embryo. *Mono* means “one” and *di* means “two.” **Monocots** are angiosperms that have only one seed leaf. **Dicots**, on the other hand, produce seeds with two seed leaves. In Figure 17, you can compare the characteristics of monocots and dicots.

**Monocots** Grasses, including corn, wheat, and rice, and plants such as lilies and tulips are monocots. The flowers of a monocot usually have either three petals or a multiple of three petals. Monocots usually have long, slender leaves with veins that run parallel to one another like train rails. The bundles of vascular tissue in monocot stems are usually scattered randomly throughout the stem.

**Dicots** Dicots include plants such as roses and violets, as well as dandelions. Both oak and maple trees are dicots, as are food plants such as beans and apples. The flowers of dicots often have either four or five petals or multiples of these numbers. The leaves are usually wide, with veins that branch many times. Dicot stems usually have bundles of vascular tissue arranged in a ring.



How do the petals of monocots and dicots differ in number?

**Math Skills**

**Multiples**

Is a flower with 6 petals a monocot? To answer this question, you need to determine if 6 is a multiple of 3. A number is a multiple of 3 if there is a nonzero whole number that, when multiplied by 3, gives you that number.

In this case, 6 is a multiple of 3 because you can multiply 2 (a nonzero whole number) by 3 to get 6.

$$2 \times 3 = 6$$

Therefore, a flower with 6 petals is a monocot. Other multiples of 3 include 9 and 12.

**Practice Problem** Which of these numbers are multiples of 4?

6, 10, 12, 16



## Angiosperms in Everyday Life

Angiosperms are an important source of food, clothing, and medicine for other organisms. Plant-eating animals, such as cows, elephants, and beetles, eat flowering plants such as grasses as well as the leaves of trees. People eat vegetables, fruits, and cereals, all of which are angiosperms.

People also produce clothing and other products from angiosperms. For example, the seeds of cotton plants, like the ones you see in Figure 18, are covered with cotton fibers. The stems of flax plants provide linen fibers. The sap of rubber trees is used to make rubber for tires and other products. Furniture is often made from the wood of maple, cherry, and oak trees. Some important medications come from angiosperms, too. For example, the heart medication digitalis comes from the leaves of the foxglove plant.



**What are two angiosperms from which people produce clothing?**



FIGURE 18

### Cotton Bolls

Angiosperms, such as cotton plants, provide many important products. Cotton seeds, which develop in fruits called bolls, are covered with fibers that are manufactured into cotton fabric.

## Section 3 Assessment

**Target Reading Skill Building Vocabulary**  
Use your sentences to help you answer the questions below.

### Reviewing Key Concepts

- a. Reviewing** What two characteristics do all angiosperms share?  
**b. Comparing and Contrasting** Do gymnosperms share either of the two characteristics with angiosperms? Explain.
- a. Identifying** What is the function of an angiosperm's flowers?  
**b. Describing** Describe the role of a flower's sepals, petals, stamens, and pistil.
- a. Reviewing** On what part of a flower must pollen land for pollination to occur?  
**b. Sequencing** Briefly describe the steps in the reproduction of an angiosperm, from pollination to seed dispersal.  
**c. Making Judgments** Do you agree or disagree with the following statement? Animals are essential in order for reproduction in angiosperms to occur. Explain your answer.

- a. Listing** Name the two major groups of angiosperms.  
**b. Comparing and Contrasting** How do the seeds, leaves, stems, and flowers of these two groups differ?  
**c. Classifying** A plant's leaves have parallel veins, and each of its flowers has six petals. To which group does it belong? Explain.

### Math

### Practice

- 5. Multiples** Which of the following numbers are multiples of 3? Which of the numbers are multiples of 4?  
5, 6, 8, 10, 12, 15
- 6. Multiples** Suppose you found a flower with 12 petals. Would you know from the number of petals whether the flower is a monocot or a dicot? Explain.

## Lab Zone Chapter Project

**Keep Students on Track** Observe the growth of plants. If some of them are dying, discuss their care with students. When the plants flower, help students pollinate them. The two best methods are to use the bee parts that come in a seed-growing kit, or tap the flower gently, collecting the pollen that

falls on a sheet of paper. The pollen can then be placed in the stigma of the plant. A third method is to use a cotton swab, but this may not be as successful. Discuss with students how these methods compare to the way plants are pollinated in nature.

## Monitor Progress L2

### Answers

**Figure 17** The leaves of monocots have parallel veins. The leaves of dicots have branching veins.



Monocots have petals in multiples of three; dicots

have petals in multiples of four or five.



Cotton plant and flax plant.

## Assess

### Reviewing Key Concepts

- a.** They produce flowers and seeds encased in fruits. **b.** No; gymnosperms do not produce flowers and their seeds are naked.
- a.** Reproduction **b.** Sepals—protect the developing flower; petals—attract pollinators; stamens—male reproductive part; pistil—female reproductive part
- a.** Stigma **b.** Pollen falls on a stigma. The sperm cell and egg cell join in the ovule and a zygote develops into the embryo part of the seed. The seed matures, a fruit develops around it, and the seed is dispersed, often with the help of animals. **c.** Possible answer: Agree; animals help pollinate flowers and disperse seeds, and thus help plants reproduce and develop into new plants.
- a.** Monocots and dicots **b.** Monocots: one cotyledon, leaves with parallel veins, stems show scattered bundles of vascular tissue, flower parts are three or multiples of three; dicots: two cotyledons, leaves with branching veins, stem contains a circle of vascular tissue, flower parts are four or five or multiples of four or five **c.** Monocot; its leaves have parallel veins, and six is a multiple of three.



6, 12, 15; 8, 12



No; 12 is a multiple of 3 and 4.

### Reteach

Review the life cycle of angiosperms.

L1

### All in One Teaching Resources

- [Section Summary: Angiosperms](#)
- [Review and Reinforce: Angiosperms](#)
- [Enrich: Angiosperms](#)

## A Close Look at Flowers

### Prepare for Inquiry

#### Key Concept

Flowers contain several distinct parts whose structures can be studied for a more complete understanding of their functions.

#### Skills Objectives

After this lab, students will be able to

- Observe the structures of flowers
- Infer the method of pollination and classify the plant as a monocot or a dicot
- Measure petal size, and the heights of pistil and stamen



**Class Time** 40 minutes

#### All in One Teaching Resources

- [Lab Worksheet: A Close Look at Flowers](#)

#### Advance Planning

Provide a variety of flowers so that students can observe more than one type. Use large- or medium-sized flowers that have all the essential structures, such as tulips, lilies, gladiolas, daffodils, petunias, and others.

#### Safety



Before starting the lab, find out which students may be allergic to pollen. Provide a substitute activity for these students, or make other arrangements. Make sure all students wash their hands immediately after this activity. Teach scalpel safety. Substitute scissors for scalpels whenever possible. Advise students to take care not to drop the glass microscope slides. Review the safety guidelines in Appendix A.

## A Close Look at Flowers

### Problem

What is the function of a flower, and what roles do its different parts play?

### Skills Focus

observing, inferring, measuring

### Materials

- paper towels
- plastic dropper
- hand lens
- microscope
- slide
- large flower
- coverslip
- scalpel
- tape
- water
- metric ruler
- lens paper

### Procedure



#### PART 1 The Outer Parts of the Flower

1. Tape four paper towel sheets on your work area. Obtain a flower from your teacher. While handling the flower gently, observe its shape and color. Use the ruler to measure it. Notice whether the petals have any spots or other markings. Does the flower have a scent? Record your observations with sketches and descriptions.
2. Observe the sepals. How many are there? How do they relate to the rest of the flower? (*Hint: The sepals are often green, but not always.*) Record your observations.
3. Use a scalpel to carefully cut off the sepals without damaging the structures beneath them. **CAUTION: Scalpels are sharp. Cut in a direction away from yourself and others.**
4. Observe the petals. How many are there? Are all the petals the same, or are they different? Record your observations.

#### PART 2 The Male Part of the Flower

5. Carefully pull off the petals to examine the male part of the flower. Try not to damage the structures beneath the petals.
6. Observe the stamens. How many are there? How are they shaped? How tall are they? Record your observations.
7. Use a scalpel to carefully cut the stamens away from the rest of the flower without damaging the structures beneath them. Lay the stamens on the paper towel.
8. Obtain a clean slide and coverslip. Hold a stamen over the slide, and gently tap some pollen grains from the anther onto the slide. Add a drop of water to the pollen. Then place the coverslip over the water and pollen.
9. Observe the pollen under both the low-power objective and the high-power objective of a microscope. Draw and label a pollen grain.



## Guide Inquiry

### Invitation

Ask: **What is the function of the flower?** (*Reproduction*) Ask students to think about how each structure of the flower relates to the two stages of reproduction in angiosperms—pollination and fertilization.

### Introduce the Procedure

- Introduce or review the use of a microscope and how to make a wet mount.
- To obtain pollen samples, students can simply tap the stamen of the flower if sufficiently developed. If the flower has just opened, demonstrate how to crush the stamen against the slide.

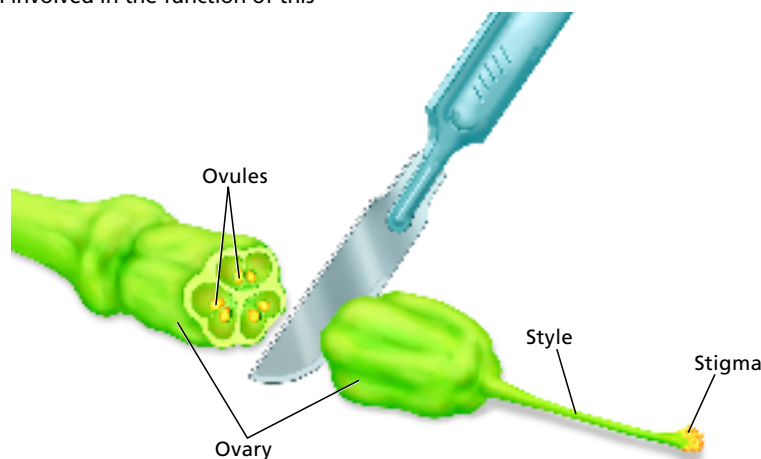


### PART 3 The Female Part of the Flower

10. Use a scalpel to cut the pistil away from the rest of the flower. Measure the height of the pistil. Examine its shape. Observe the top of the pistil. Determine if that surface will stick to and lift a tiny piece of lens paper. Record your observations.
11. Lay the pistil on the paper towel. Holding it firmly at its base, use a scalpel to cut the pistil in half at its widest point, as shown in the diagram below. **CAUTION:** *Cut away from your fingers.* How many compartments do you see? How many ovules do you see? Record your observations.

### Analyze and Conclude

1. **Observing** Based on your observations, describe how the sepals, petals, stamens, and pistils of a flower are arranged.
2. **Inferring** How are the sepals, petals, stamens, and pistil involved in the function of this flower?



3. **Measuring** Based on your measurements of the heights of the pistil and stamens, how do you think the flower you examined is pollinated? Use additional observations to support your answer.
4. **Classifying** Did you find any patterns in the number of sepals, petals, stamens, or other structures in your flower? If so, describe that pattern. Is your flower a monocot or a dicot?
5. **Communicating** Write a paragraph explaining all you can learn about a plant by examining one of its flowers. Use your observations in this lab to support your conclusions.

### More to Explore

Some kinds of flowers do not have all the parts found in the flower in this lab. Obtain a different flower. Find out which parts that flower has, and which parts are missing. *Obtain your teacher's permission before carrying out your investigation.*

### Troubleshooting the Experiment

- If pollen begins to fall off as students handle the flowers, they can collect it on a sheet of paper and put it aside for Steps 8–9.
- Make sure students do not grip the test tubes too tightly. Remind students to tell you immediately if any glass is broken.

### Expected Outcome

- The top of the pistil (the stigma) may be rough, smooth, sticky, branched, or feathery.
- The number of chambers in the ovary is equal to or is a multiple of the number of petals and stamens.

### Analyze and Conclude

1. In circles, in this order: sepals on the outside, then petals, then stamens, the pistil at the center.
2. The sepals protect the flower as it develops and support the base of the flower. The petals may attract the attention of animals by color or scent. Stamens produce pollen, which releases sperm cells. Pistils hold the egg cells.
3. Answers will vary. Possible answers: Colorful petals suggest the flower is pollinated by organisms attracted to colors. A pistil that is taller than the stamens may suggest that the flower does not self-pollinate. A flower structure in which the anthers and stigma are located deep within the flower suggests pollination by small pollinators such as insects or hummingbirds.
4. Flower parts of monocots are usually in threes or multiples of threes. Flower parts of dicots are usually in fives or fours, or multiples of those numbers.
5. Answers will depend on students' observations. Paragraphs should indicate that examination of the flower parts can determine how the structures are arranged in a flower, how the flower parts function relative to one another, the most likely way the flower is pollinated, and whether the flower is a monocot or a dicot.

### Extend Inquiry

**More to Explore** Make certain students' second flower is different from the first flower they examined. Upon comparing flowers, students will discover that flowers

vary greatly in structure. For example, some plants have separate male and female flowers, whereas some have male and female parts in different relative positions.